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# Statistical mechanics approaches to granular media: between micromechanics and macromechanics

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## ABSTRACT

The mechanical behavior of granular materials has been traditionally approached through two theoretical and computational frameworks: macromechanics and micromechanics.

Macromechanics focuses on continuum based models. In consequence it is assumed that the matter in the granular material is homogeneous and continuously distributed over its volume so that the smallest element cut from the body possesses the same physical properties as the body. In particular, it has some equivalent mechanical properties, represented by complex and non-linear constitutive relationships. Engineering problems are usually solved using computational methods such as FEM or FDM.

On the other hand, micromechanics is the analysis of heterogeneus materials on the level of their individual constituents. In the case of granular materials, if the properties of particles are known, a micromechanical approach can led into a predictive response of the whole heterogeneous material. Two classes of numerical techniques can be differentiated: computational micromechanics, which consists on applying continuum mechanics on each of the phases of a representative volume element and then solving numerically the equations, and atomistic methods (DEM), which consist on applying rigid body dynamics together with interaction potentials to the particles.

Statistical mechanics approaches arise between micro and macromechanics. It tries to state which the expected macroscopic properties of a granular system are, by starting from a micromechanical analysis of the features of the particles and the interactions. The main objective of this paper is to introduce this kind of approaches and, in particular, how wetting or roughness can be analyzed within a statistical mechanics framework.

## REFERENCES

[1] I. G. Tejada and R. Jimenez, “Statistical Mechanics as guidance to particle based computational methods”, accepted to *Engineering Computations*, (2012)